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ABSTRACT

Particularly in the 1960s and 1970s it was frequently argued that coeducational (Coed) high schools provided a more natural social environment to prepare adolescents for adulthood than did single sex (SS) schools. Based on the assumed accuracy of this belief, SS schools are becoming infrequent or even nonexistent in most western societies. This investigation was designed to provide information about the effects of the transition from SS to Coed high schools. This 5-year longitudinal study examined the effects of the transition from SS to Coed high schools when a boys' high school and girls' high school were reorganized into two Coed high schools, involving approximately 2,250 students sometime during the period from 1982 through 1985. Students were compared on self-concept and academic achievement before, during, and after the transition, and detailed perceptions were also collected from teachers who taught at the schools before, during, and after the transition. For both boys and girls there was a clear increase in multidimensional self-concepts from the pre-transition to post-transition, despite a small decrease in self-concepts for students attending Coed classes during the transition year. Sex differences in specific areas of self-concept were unaffected by the transition. Across the 5 years of the study there were no significant differences in either mathematics or English achievement. Results suggest that the transition to Coed benefited both boys and girls in multpile dimensions of self-concept and that these benefits were not gained at the expense of academic achievement. (ABL)

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The Transition From Single-Sex to Coeducational High Schools: Teacher Perceptions, Academic Achievement, and Self-concept

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The Transition From Single-Sex to Coeducational High Schools: Teacher Perceptions, Academic Achievement, and Self-concept

SUMMARY

The purpose of this paper is to summarize a five-year longitudinal study of the effects of the transition from single-sex high schools to coeducational high schools. During this period two single-sex high schools serving the same geographical area formed two coeducational high schools. The results of the present investigation are presented in three parts: (1) the impact of the transition from the perspective of teachers and staff who taught at the schools before, during, and after the transition; (2) the performance of Year 10 students on externally moderated examinations in English and mathematics before, during, and after the transition, and (3) student responses to a multidimensional self-concept instrument before, during, and after the transition. In each part the differential effects of the transition on boys and on girls are examined. The findings suggest that the transition benefited both boys and girls in terms of multiple dimensions of self-concept and that these benefits were not at the expense of academic achievement for either boys or girls.

INTRODUCTION

Particularly in the 1960s and 1970s it was frequently argued that coeducational (Coed) high schools provided a more natural social environment to prepare adolescents for adulthood than do single-sex (SS) schools (e.g., Dale, 1969; 1971; 1974). Based in part on the assumed accuracy of this contention, public single-sex (SS) schools are becoming infrequent or even nonexistent in most western societies. Coleman, however, suggested that coeducation "may be inimical to both academic achievement and social adjustment" (1961, p. 51) and, more recently, other researchers have proposed that coeducation may be particularly detrimental for girls (see Bone, 1983; Carpenter & Hayden, 1987; Foon, 1988; Mahony, 1985; Shaw, 1980; Spender & Sarah, 1980; Willis & Kenway, 1986). Willis and Kenway, for example, indicated that "single-sex schooling, in some form, is offered by many feminists as one strategy for overcoming sexist educational practices" (p. 132), but they noted the dubious logic and evidence typically used to support this strategy. Given the important policy implications of such questions, there is surprisingly little well-controlled research, apparently because of a relative lack of SS schools and because of the complexities inherent in the non-equivalent group comparisons used in most research.

The present investigation was designed to provide information about the effects of the transition from SS to Coed high schools. A boys' school (BHS) and a girls' school (GHS) serving the same community were reorganized to form two Coed schools. In a five-year longitudinal design, students were compared on self-concept and academic achievement before, during, and after the SS/Coed transition, and detailed perceptions were also collected from teachers who taught at the schools before, during, and after the transition.

The Research of R. R. Dale

Historically, the most important research on SS/Coed differences is Dale's extensive research programme conducted in England and Wales (1969, 1971, 1974). Dale's research may be characterized as voluminous, opinionated -- he is unabashedly in favour of coeducation and sought empirical support for his position -- and policy oriented. Dale examined the SS/Coed issue from the perspectives of teachers and in relation to students' social development and to their academic achievement. A detailed review of Dale's research -- its strengths and its weaknesses -- is beyond the scope of this article, but his major conclusions were: (1) from the perspective of teachers the advantages of coeducation are social (e.g., preparation for life, the naturalness of boy-girl interactions whereas the disadvantages, especially for girls, are academic and organizational (e.g., low subject achievement,

limiting of options for girls, insensitivity to different attitudes, interests, abilities) [Dale, 1969, pp. 239-240]; (2) "It has been demonstrated that the average coeducational grammar school is a happier community for both staff and pupils than the average single-sex school" (Dale, 1974, p. 273); and (3) "A cautious summing up would be that the progress of boys is probably improved by co-education while that of girls is not harmed" (Dale, 1974, p. 267) so that the social and affective benefits of coeducation were not at the expense of academic progress (1974, p. 273).

The relevance of Dale's research for current issues was reviewed by Bone (1983). Although recognizing the important contribution of Dale's research, she indicated that "there are good reasons why his conclusions cannot be regarded as the last word on the issue as it stands today" (p. 8). In particular she noted that Dale was studying particular schools during a particular time, primarily British grammar schools between 1947 and 1967.

More Recent Research into SS/Coed Differences

Interpretations of SS/Coed comparisons are hampered by the typical nonequivalent group comparisons used in most research. Because single-sex schools are more likely to be selective, their students are typically brighter, come from higher socioeconomic backgrounds, and differ from Coed students on a variety of other pre-existing variables that probably invalidate the interpretation of SS/Coed comparisons (e.g., Willis & Kenway, 1986). Studies that do not control for such influences cannot be given great weight and, perhaps, should not even be considered seriously. Even those that do must be interpreted cautiously because of all the difficulties inherent in using statistical procedures to equate nonequivalent groups (Marsh, in press-a).

SS/Coed Differences in Self-concept. Researchers (e.g., Campbell, 1969; Feather, 1974; Foon, 1988; Jones, Shallcross & Dennis, 1972; Harris, 1986; Lee & Bryk, 1986; Marsh, in press-a; Schneider & Coutts, 1982) have compared high school students from SS and Coed schools on social and affective variables. Only Foon (1988), Lee and Bryk (1986), and Marsh (in press-a), however, specifically considered self-concept. Foon (1988) compared self-esteem in non-equivalent groups with no attempt to control for any pre-existing differences, and so the effects of pre-existing differences cannot be differentiated from legitimate school-type effects (see Marsh, in press-a). Lee and Bryk (1986) and Marsh (in press-a) compared Catholic high school students attending SS and Coed schools that were part of the large, nationally representative High School and Beyond study of high school students in the United States. Although there were important methodological differences between the two studies, both found little or no difference

between single-sex and Coed students on gain scores during the last two years of high school that were designed to control for pre-existing differences.

SS/Coed Differences in Academic Achievement. Recent comparisons of achievement levels in SS and Coed schools (e.g., Bone, 1983; Carpenter, 1985; Finn, 1980; Lee & Bryk, 1986; Marsh, in press-a; Steedman, 1983; 1984; Willis & Kenway, 1986) typically show that academic achievement is substantially higher in SS schools than in Coed schools. Once pre-existing differences such as intelligence and social class differences are controlled, however, the differences tend to be small or nonsignificant. The differences, therefore, are largely explicable in terms of the characteristics of students who attend SS and Coed schools rather than the types of schools. For example, Steedman (1983, 1984) examined academic achievements in a large, representative sample of 16 year-old boys and girls in SS and Coed schools after correcting for achievement at ages 7 and 11 and for family background variables. She concluded that "very little in these examination results is explained by whether schools are mixed or single-sex once allowance has been made for differences at intake (Steedman, 1984, p. 98).

Multiple Dimensions of Self-concept

A detailed review of self-concept research and its relevance to this study is beyond the scope of the present chapter. There are three conclusions from such research that are particularly relevant: (1) Historically, researchers have emphasized a general or overall self-concept whereas recent theoretical and empirical research has focused on the multidimensionality of self-concept. In a review of this research Marsh and Shavelson (1985) concluded that self-concept cannot be adequately understood if this multidimensionality is ignored. (2) There is evidence of a systematic decline in self-concept during preadolescent years that appears to level out during early adolescence, followed by a subsequent increase that continues at least into early adulthood (e.g., Marsh, 1985; in press-b; in press-c; Marsh, Barnes, Cairns & Tidman, 1984; Marsh, Parker & Barnes, 1985). In a study of Australian high school students similar in age to those in the present investigation, Marsh, Parker and Barnes (1985) reported such a relation in which self-concepts declined between Years 7 and 9, leveled off, and increased between Years 9 and 12. (3) There are systematic sex-differences in different dimensions of self-concept -- some favouring girls, some favouring boys -- that are consistent with sex stereotypes (Dusek & Flaherty, 1981; Marsh, 1985; 1i press-a; in press-b; Marsh, et al., 1984; Marsh, Parker & Barnes, 1985; Marsh, Relich & Smith, 1983; Marsh, Smith & Barnes, 1985). For example, girls tend to have higher self-concepts for

Reading and General School whereas boys had higher self-concepts for Physical Ability, Mathematics, and Physical Appearance.

METHOD

An Overview of the Design

In 1982 a boys' high school (BHS) and girls' high school (GHS) were separate single-sex high schools which served the same suburb of metropolitan Sydney. However, due to a plan initiated largely by parents, the decision was made to form two coeducational high schools from these two single-sex schools. In order to keep disruption to a minimum for students who were preparing for external examinations, those in Year 10 and particularly those in Year 12, the transition was designed to take place over two years. In 1983 students in years 7, 9 and 11 in both schools attended coeducational classes whereas students in years 8, 10 and 12 continued to attend single-sex classes. Starting in 1984 all students attended coeducational classes in both high schools. School administrators had, for their own reasons, thus created a well-designed setting to study the longitudinal implications of the transition from single-sex high schools to coeducational high schools. Our research team was invited to examine the effects of the transition in this naturally occurring quasi- experimental design.

The purpose of the present investigation is to examine the effects of the transition from single-sex to coeducational high schools based on teacher perceptions, on student performance, on the externally moderated School Certificate examination completed by all year 10 students, and on student responses to a multidimensional self-concept instrument. The investigation is a five-year longitudinal study: student academic achievement was assessed during all five years (1982-86), self-concepts were collected during the first four years (1982-85) and teachers completed a detailed survey in 1985.

In the first year of the study, the pre-transition phase, all students attended single-sex classes and data collected during this year served as baseline data. In the second year of the study, the transitional year, students in Years 7, 9 and 11 attended coeducational classes in both high schools and students in Years 8, 10, and 12 continued attending single-sex classes in their same high school. In the subsequent three years of the study, the post-transition phase, all students attended coeducational classes in both high schools.

Subjects

Students in the study were the approximately 2,250 students attending BHS or GHS at some time during the five-year period period 1982-1985. For present purposes, students in years 7-11 were considered in the evaluation of

self-concepts and students in just year 10 were considered in the evaluation of academic achievements. Students in Years 7-11 were predominantly 12 or 13, 13 or 14, 14 or 15, 15 or 16, and 16 or 17 years of age respectively. Approximately half the students in each year group were girls. For purposes of evaluating academic achievement, the 1257 students who were awarded a school certificate at the end of year 10 during the five-year period of 1982-86 were considered. For purposes of evaluating self-concepts, all students in years 7-11 completed the self-concept instrument each year of the study unless they were absent from school the day the instrument was administered. During the four-year period of 1982-85 a total of 3,816 self-concept instruments were completed.

Teachers in the study were the approximately 100 teachers who taught at BHS or GHS during 1985. A total of 88 of these teachers completed relevant parts of the teacher survey. Most of the analyses presented here are based on responses by the 50 teachers (63% of respondents) who had taught at one of the two schools before, during and after the transition.

Measurement Instruments

Teacher perceptions are based on responses to a questionnaire developed specifically for this study and is described in greater detail as part of the results (also see Owens, Marsh, Myers and Smith, 1986). Academic achievement scores were based on the externally moderated School Certificate test administered by the Department of Education to all Year 10 students in the state of New South Wales and are described in greater detail as part of the presentation of the results (also see Marsh, Smith, Myers & Owens, 1986a).

The Self Description Questionnaire (SDQ) II is a commercially available, standardized instrument (Marsh, in press-c) designed to measure 11 dimensions of self-concept (see Table 4 for a listing of the dimensions). In previous research (Marsh, Parker & Barnes, 1985), factor analyses clearly identified each of the 11 SDQ II factors, the reliability of each scale was high (median alpha = 0.86), correlations among the 11 factors were modest (median r = .17), the scales were significantly and logically related to gender, and school performances in math and English classes were substantially correlated with Math and Verbal self-concepts but relatively uncorrelated with self-concepts in nonacademic areas. Further evidence concerning the dimensionality, reliability, and validity of responses to the SDQII age available in the test manual (Marsh, in press-c).

RESULTS

Teacher Perceptions

Near the end of the fourth year of the study, almost two years after the

first introduction of Coed classes, teachers were asked to complete a lengthy questionnaire detailing their perceptions of the processes and the effects of the transition. Because of the timing of the questionnaire, teacher perceptions of what their school was like before the transition were necessarily based on memory and hindsight. At both BHS and GHS the surveys were administered at staff meetings at which nearly all teachers were present. Most of the analyses to be presented here are based on the responses by 50 teachers who had taught in one of the two schools before, during, and after the transition, representing 63 % of the total number of respondents. The focus of this analysis is on teacher preferences for SS and Coed schools, teacher perceptions of changes in the overall educational quality as a consequence of the SS/Coed shift, and their comparison of SS and Coed schools in terms of social, affective and academic achievement outcomes. In addition, however, all teachers were asked to comment generally on the advantages and disadvantages of SS and Coed schooling. Content analyses of just these responses were based all teachers.

Teacher support for the SS/Coed shift.

When asked to indicate whether or not they favoured the SS/Coed shift (See Table 1), teachers indicated (retrospectively since surveys were completed at the end of the study) that they had favoured it before the transition and during the transition, and that they remained in favour of the shift after its completion. Statistical analyses indicated that there was no significant change in the level of support during this four-year period, and that responses did not vary significantly according to the school at which the teacher taught or the gender of the teacher. Consistent with these findings, when asked to list important advantages and disadvantages of the shift from SS to Coed schools, teachers listed nearly twice as many advantages as disadvantages. These results show that teachers were clearly in favour of the shift.

Insert Table 1 About Here

Overall educational quality.

Teachers evaluated the overall educational quality as a consequence of the SS/Coed transition for younger and older girls and for younger and older boys (Table 1). Overall, they indicated that the educational quality was significantly better as a consequence of the shift. Whereas this improvement did not depend on the age of the student, it did vary according to the gender of the student. For boys, teachers perceived that the shift had resulted in an improvement in the educational quality. For girls, however, teachers indicated that educational quality was neither better nor poorer. These

results did not vary significantly as a function of the school at which the teacher taught or the gender of the teacher.

Student preferences.

According to teacher perceptions, both boys and girls overwhelmingly prefer Coed to SS schools (Table 2). Boys' preferences for Coed schools were, however, perceived to be stronger than those of girls.

Insert Table 2 About Here

Advantages of SS and Coed schools for boys and girls.

Teachers were asked to evaluate the differential advantages of SS and Coed schools separately for boys and for girls (Table 2). The first 11 comparisons refer to school climate and to social and affective characteristics, whereas the last 9 refer to academic achievement in specific academic subjects.

Boys, according to teacher perceptions, were generally advantaged by Coed schools. For the 20 areas considered, boys were significantly advantaged by Coed schools in 11 and were not significantly advantaged by SS schools in a single area. The areas in which boys were advantaged by Coed schools include social development (e.g., maturity, leadership, dress/appearance, interpersonal behaviours) and academic achievement (in English, languages, social sciences, music/arts, and particularly home sciences).

For girls, teachers perceived advantages in both single-sex and Coed schooling. Girls were seen to prefer Coed schools and to be advantaged in some social areas (e.g., maturity, interpersonal behaviors, and dress/appearance) by Coed schools. In contrast, teachers perceived girls to be more likely to assert themselves, to desire to do well in school, and to experience a competitive learning environment, and to be less likely to create discipline problems in SS schools. Girls' academic achievement in maths/science and in computer sciences was perceived by teachers to be better in SS schools, whereas achievement in industrial arts is perceived to be advantaged in Coed schools.

Teacher Comments

Teachers were invited to expand on their responses to questionnaire items with comments at the end of each section and finally to indicate overall advantages and disadvantages to the SS/coed shift. Each of the co-authors of the study initially read complete transcripts of comments by all teachers to identify salient themes that were used to form a master checklist. The transcripts were then coded according to this checklist and, through discussion, consensus was reached as to the classification of comment by each teacher. For present purposes, selected themes are summarized in

Table 3 along with exemplar verbatim quotes from the teachers' comments.

Insert Table 3 About Here

Many of the teacher comments -- particularly the more specific comments -- did not reflect an advantage of either coed or SS schools. For those comments that did reflect an advantage, the advantages of coed schooling were offered almost twice as frequently as the advantages of SS schools. The overriding advantage of coeducation offered by teachers was some variant of the theme that it is a reflection of the real world, a more natural and normal environment, and assists in breaking down stereotyping and prejudices (see exemplar advantages in Table 3). Disadvantages were more frequently related to negative qualities of boys and their impact on girls in a coed setting and in difficulties that teachers have in maintaining discipline.

Summary of Teacher Perceptions

Teachers perceived that boys and girls overwhelmingly preferred Coed to SS schools. Similarly, at both schools teachers themselves were strongly in favour of the shift to coeducation before the event, and remained so during and after transition. Teachers' written comments on the questionnaire indicated that, despite misgivings, coeducation was seen as a model of relationships in the wider society, and as a place to develop skills for surviving and succeeding in that society. The ameliorating influence of the presence of girls on the behavior of boys was also noted as well as the disruptive influence of boys on girls and the deference of the girls to boys. Boys in particular were seen to be advantaged by coeducation in both personal/social growth and in academic achievement. Beliefs about the advantages of coeducation for girls were more ambivalent. Despite some social/personal advantages of coeducation for girls, girls were seen to benefit from the competitive learning environment of single-sex schools which may be linked with a desire to do well and to be assertive. Girls were also seen to do better in maths/science and in computer sciences in SS schools. Teachers perceived that the overall educational quality for boys had improved as a consequence of the shift whereas the overall educational quality had not changed for girls.

Academic Achievement

The purpose of this section is to summarize the effects of the SS/Coed transition on school performance. It was originally intended that this purpose would be served by school performance measures in different academic areas for students from all grade levels in each year of the study. However, this proved unrealistic due to the shift away from standardized testing and uniform performance reporting and due to various strategies of ability

grouping used in BHS and GHS during the course of the study. Instead, this purpose is served by scores on the externally moderated School Certificate scores for all Year-10 students in mathematics and English.

All Year-10 students in the state of New South Wales complete standardized examinations in English and mathematics administered by the NSW State Department of Education. Scores on these examinations are used to determine the distribution of grades that are to be awarded by each high school. That is, high schools that score better on the standardized examination award correspondingly higher grades to their students. However, the assigned grades are based on school performance measures established by each high school. Thus, school performance is the basis of the relative ranking of students within each high school, but the translation of the school performance measures into grades is externally moderated according to the school's performance on the standardized examination. For this reason, School Certificate scores are comparable from one school to the next and from one year to the next even though they are based on internal assessments.

The present investigation focuses on two major questions. First, do students attending single-sex classes earn different School Certificate scores in English and mathematics than students attending coeducational classes? Second, do sex differences in school performances in English and mathematics differ for students in SS and Coed classes? It was anticipated that girls would score higher than boys in English and, perhaps, lower in mathematics. The question to be addressed here is whether such sex differences are larger or smaller for students attending single sex classes than for those attending coeducational classes.

As described earlier, students who were in Year 10 in 1982 and 1983 attended SS classes, those who were in Year 10 in 1984-1986 attended Coed classes. Hence the basic design is a comparison of performances by boys and girls across the five years. An overview of the results (Figure 1) shows that performances by Year-10 students -- both males and females -- was remarkably consistent across the five years of the study. As substantiated by a variety of statistical analyses, these results show little or no difference in mathematics or English scores from one year to the next. While there are sex differences in the expected direction -- girls performing relatively better at English and relatively poorer at mathematics than boys -- these sex differences are also very consistent across the four years of the study. These findings suggest that the transition does not systematically affect school performance by girls or boys in English or mathematics.

Insert Figure 1

School performance in English.

During the 1982-86 period of the study, Year-10 students from both BHS and GHS were awarded grades of 1 to 5 in English. Across the entire state of New South Wales, the grades of 1 - 5 were given to 10%, 20%, 40%, 20%, and 10% of the students respectively. The distribution of grades awarded in any particular high school depended on that school's performance on the reference test taken by all Year-10 students in the state for that year. Across all four years of the study and all students from both BHS and GHS, the distribution of English grades was roughly similar to the distribution across the entire state. In order to facilitate comparisons and also because of the confidential nature of the School Certificate grades, the English grades were standardized (Mean = 50, SD = 10) across all students in all five years of the study such that higher scores reflected better academic performance.

A 5 (time: 1982, 1983, 1984, 1985, 1986) x 2 (sex) ANOVA was performed on the entire set of English grades. As suggested in Figure 1, there were no significant differences in English performance across the five years of the study ($F(4, 1247) = 1.22$, $p = .303$). Girls performed substantially better at English than boys ($F(2, 1247) = 99.76$, $p < .001$) but there was no change in the size of this sex difference across the five years ($F(4, 1247) = 0.97$, $p = .420$). During all five years of the study there were girls attending GHS and boys attending BHS. For this reason separate analyses were also conducted to determine if there was a shift in performance for either group. Consistent with earlier findings, there was no significant difference in the performances of either girls attending GHS or boys attending BHS across the four years. These results suggest that the transition had little or no effect on school performance in English. English performance did not vary across the five years of the study for all students from both schools, nor for girls who attended GHS , nor for boys who attended BHS. Although there were stereotypic sex differences in English performance, the size of this sex difference was also consistent across the five years of the study.

School performance in mathematics.

Interpretations of mathematics achievement was complicated by a policy change in the way School Certificate grades were awarded in mathematics. Prior to and during 1982, grades of 1-5 were awarded in mathematics according to the same procedure used for English grades. In 1983, however, the Department of Education in New South Wales introduced a new multi-level mathematics curriculum. Because of this policy change, students completed one of three separate examinations according to whether they had studied mathematics at the advanced, intermediate, or general level. Furthermore, in

1983 and 1984, individual high schools were given the option of continuing with the old system that resulted in 1-5 grades in mathematics or the new system of stream-specific grades. BHS chose to continue with the old system for both years whereas GHS chose to use the new system during both years. After 1984 all schools used the new system. In summary, BHS awarded 1-5 grades (hereafter called moderated grades) in 1982-84 and stream-specific grades (hereafter called streamed grades) in 1985-86, whereas GHS awarded moderated grades in 1982 and streamed grades in 1983-86.

Moderated mathematics grades. In 1982 all students were in SS schools and received moderated mathematics grades. In 1982 the advantage of boys over girls seen in Figure 1 was shown to be nonsignificant ($F(1, 257)=0.9$, $p=.34$). In 1983 all Year-10 students again attended single sex classes, but all boys had moderated grades whereas all girls had streamed grades. In 1984 boys and girls from BHS had moderated grades and these were compared with the moderated grades from both high schools in 1982. The male/female difference again failed to reach statistical significance ($F(1, 367)=2.11$, $p=.15$) and this lack of difference did not interact with the year of the study ($F(1, 367)=0.29$, $p=.59$). Scores in 1984 were marginally higher than in 1982, but this difference also failed to reach statistical significance ($F(1, 367) = 3.8$, $p=.052$). Finally, the moderated grades for boys from BHS were compared for 1982-1984. While 1984 grades were somewhat higher, the difference was not statistically significant ($F(2, 309)= 1.55$, $p=.21$). These results suggest that the transition had little effect on the moderated mathematics grades or on male/female differences in these grades.

Streamed Grades. Streamed grades were available for girls attending SS classes at GHS in just 1983 but not for boys attending single-sex classes. In the first comparison of these grades, the proportion of girls in the three ability streams did not vary during the 1983-86 period at GHS ($X^2(6) = 5.03$, $p = .54$). Similarly, the ratio of boys to girls in each of the streams for both schools did not vary in the 1985-86 period ($X^2(2)=0.47$, $p=.79$) when all students from both high schools attended Coed classes and were assigned to streams. These results suggest that the assignment of girls to the different ability groupings in mathematics did not vary as a function of the transition, and that boys and girls were equally likely to be assigned to the different streams after the transition.

Combined moderated and streamed grades. Because students in different streams were given different tests, the streamed grades were not easily compared across the streams. However, the pattern of grades and their relation to English grades by the same students were used to scale the

different mathematics tests. Several different scaling procedures each resulted in similar results. The set of moderated mathematics grades and the set of streamed grades after scaling were each standardized (Mn = 50, SD = 10) separately, combined to form one set of grades, and then restandardized (Mn=50, SD=10) as shown in Figure 1. (See Marsh, Smith, Myers & Owens, 1986a, for further discussion and justification of the combining of the different mathematics scores.)

A 5 (time: 1982-1986) x 2 (sex) ANOVA was conducted on this combined set of mathematics grades. The results of this analysis support the earlier interpretation of Figure 1 and findings based on moderated and streamed grades considered separately. Across the five years of the study there was no significant difference in mathematics performance ($F(4, 1226) = 1.37$, $p = .241$). Although boys seemed to perform slightly better at mathematics than girls, this difference did not reach statistical significance ($F(1, 1226) = 2.10$, $p = .147$). Furthermore, this lack of sex difference was consistent across the five years of the study as indicated by the nonsignificant sex-by-time interaction ($F(4, 1226) = 0.10$ $p = .912$). Consistent with earlier findings, there was no significant difference in the mathematics performances of either girls attending GHS or boys attending BHS high school across the five years.

In summary, these results suggest that the transition had little or no effect on school performance in mathematics. Mathematics performance did not vary across the five years of the study for boys or girls, for girls who attended GHS, or for boys who attended BHS. There were little or no sex differences in mathematics performance and this absence of sex differences was also consistent across the five years of the study. Results based on mathematics grades must be interpreted more cautiously than those based on the English grades because of the change in how mathematics grades were determined. Nevertheless, the conclusions are consistent over a wide variety of comparisons based on moderated grades, streamed grades and the combined grades.

Multiple Dimensions of Self Concept

The purpose of this section is to examine the effects of the transition on multiple dimensions of self-concept. These results bear on two major research questions. First, do students attending single-sex classes have systematically different self-concepts than do students attending coeducational classes, and do these differences depend on the area of self-concept? Second, does the pattern of sex differences in specific dimensions of self-concept differ in SS and Coed schools? Marsh (1985; Marsh, Parker &

Barnes, 1985) found sex differences in specific dimensions of self-concept -- some favouring boys and some favouring girls -- that were generally consistent with sex stereotypes. The question to be considered here is whether this pattern of counter-balancing sex differences can be replicated, and whether it differs in SS and Coed schools.

The effects of the SS/Coed shift were evaluated from two different perspectives. As described earlier, all students attended single-sex schools in 1982 (pre-transition phase), and all students attended coeducational schools in 1984 and 1985 (post-transition phase). Thus, a comparison of self-concepts in 1982 with those in 1984-85 provides a comprehensive test of the effect of the transition. In 1983 (transitional phase) students in Years 7, 9 and 11 attended Coed classes whereas students in Years 8 and 10 attended single-sex classes. Thus, a comparison of self-concepts for these two groups in 1983 also provides a test of the effect of the transition.

The Comparison of Self-concepts in the Pre- and Post-transition

In the first analysis a 5 (year in school: Year 7, 8, 9, 10 and 11) by 3 (Time; 1982, 1984,1985) by 2 (sex) by 11 (self concept facets) ANOVA was conducted in which the first three variables are between-subject variables and self-concept is a repeated-measures variable. In this overview of the results, emphasis will be placed on the between subject effects that are equivalent to the effects for the total scores across the 11 self-concept facets.

The results of this ANOVA and an inspection of Figure 2 indicate that across all students, self-concepts are significantly higher in the post-transition (1984-85) phase than in the pretransition (1982) phase ($F(1, 2838) = 30.50$, $p < .001$). As in previous research (e.g., Marsh, Parker & Barnes, 1985), self-concepts decreased between Years 7 and 9, and then increased between Years 9 and 11. Consistent with this observation the effect of year in school was significant ($F(4, 2838) = 3.77$ $p < .01$), and most of the effect was due to quadratic component of age ($F(1, 2838) = 11.99$ $p < .001$). Of particular interest to the present investigation, this age effect also interacted with the intervention effect ($F(1, 2838) = 8.17$ $p < .001$). Inspection of Figure 2 shows that the effect of the intervention was larger for Years 8, 9 and 10.

Insert Figure 2 and Table 3 About Here

Across all areas of self-concept boys had slightly higher scores than did girls ($F(1, 2838) = 4.38$ $p < .05$), though the size of the effect was very small. Furthermore, the improvement in self-concept between the pre- and post-transition phases occurred for both boys and girls, and the size of the improvement did not differ significantly according to student gender. The

significant gender x year x time interaction ($F(8, 2838) = 3.06$ $p < .01$) suggested that sex differences in the transition effects vary with age. The transition appeared to have more positive effects for older girls in Years 9-11 than younger girls, whereas the transition effects were most positive in Years 8-10 for boys (Figure 2).

The intervention effects also varied to some extent with the specific facet of self-concept, and this interaction varied to some extent for boys and girls (see Table 3). Post-transition scores are higher than pre-transition scores for all 11 areas of self-concept, but the differences fail to reach statistical significance for three of the scales (Mathematics, Honesty, and Relations With Parents). The largest effects are for Same Sex Relations, Emotional Stability, General Esteem, and Verbal Self-concepts. Sex differences in self-concept vary substantially depending on the area of self-concept as shown in previous research. However, the transition effects are reasonably similar for boys and girls such that these sex differences in self-concept are neither increased nor decreased due to the transition.

In summary, across all facets of self-concept, scores are higher for students attending Coed classes than for those in SS classes. This difference occurs for both boys and girls, and it is reasonably consistent across the different dimensions of self-concept. While this intervention effect does interact with other variables, these interaction effects are much smaller than the main effect of the intervention.

The Comparison of Self-concepts in the Single-sex and Coeducational Classes During the Transition Year.

In 1983 all students in Years 7, 9 and 11 began attending Coed classes whereas those from Years 8 and 10 continued attending SS classes. The comparison of responses by students in SS and Coed classes during 1983 is, however, complicated by several factors. First, year in school and the transition effects are confounded and self-concepts vary with year in school. Second, the effects of attending SS or Coed classes are confounded with the substantial logistical changes that accompanied this transition. Not only did some students attend Coed instead of SS classes, but the physical facilities of the high schools had to be altered, many teachers needed to adjust their teaching styles, some new courses were introduced, there were new demands on the nonteaching staff, and extracurricular student activities were altered (see discussion of teacher perceptions). In fact, only some of the classes were made Coed in 1983 because administrators in both schools anticipated a disruption during this transition year.

A 5 (year in school) by 2 (gender) by 11 (areas of self-concept) ANOVA

was used to examine self-concept responses during the transition (1983) phase of the study. The focus of this analysis is on the comparison of Years 7, 9 and 11 (Coed classes) with Years 8 and 10 (SS classes). Because the SS/Coed comparison is confounded with year in school, two different strategies were used. First, an inspection of the self-concepts across all four years of the study suggests that SS and Coed year groups are balanced in terms of self-concept so that the SS/Coed comparison may not be biased. For this reason, analyses were first conducted on the raw (unadjusted) scores. Second, scores for students from each year in school were standardized across 1982-1985 (mean = 0, SD = 1) separately so as to control for age effects. A second set of analyses were based on these adjusted scores. The two sets of analyses based on the adjusted and unadjusted scores resulted in similar conclusions and so only the results of the raw scores are discussed.

Results of this comparison indicated that self-concept scores are somewhat higher in single-sex classes than in Coed classes. The ANOVA results indicate that this difference is statistically significant ($F(1, 929) = 4.75$, $p < .05$) and is similar for boys and girls. For the Coed group (Years 7, 9 and 11) self-concept scores are significantly lower than the corresponding marginal mean for the corresponding grade levels (i.e, self-concept across 1982-1984). For example, the mean response of Year 11 students in 1982 was 48.1 whereas the mean response across Year 11 students from 1982-1984 was 50.9. For the two single-sex groups (Years 8 and 10), responses did not differ significantly from the corresponding marginal means for responses across 1982-85.

The juxtaposition of the comparison of self-concepts in the pre- and post-transition with the comparison within the transition phase provides different interpretations of the transition effect. In particular, the pre-post comparison indicates that self-concepts were higher in Coed classes whereas the comparison within the transition phase suggests that self-concepts were lower in the Coed classes. Our interpretation is that the process of change from SS to Coed that occurred primarily during the transition year produced a temporary negative effect during that one year (1983). In support of this interpretation: (a) each of the Years (7, 9 and 11) that shifted from single-sex to coeducation in the transition phase had lower self-concepts than the marginal average of responses by all students from the same year in school; (b) self-concepts for every cohort -- those that were SS in 1983 and those that were Coed -- improved between 1983 and 1984; (c) comments by teachers on changes produced by the transition were consistent with this interpretation; (d) school administrators employed a

two-stage transition because they expected temporary problems due the shift and wanted to protect students taking external examinations, and their plan apparently worked; and (e) Dale (1971) also documented that the sudden combining of two single-sex schools creates short-term problems that undermine the otherwise positive effects of coeducation.

In summary, during the transition year students who remained in single-sex classes had modestly higher self-concepts than students who switched to Coed classes. The results suggest there was a temporary disruption during the transition year that produced this change. Consistent with this interpretation, Coed students in this transition phase had lower self-concepts than students in the same grade level across all four years of the study whereas those for students in the single-sex classes did not differ. Also consistent with this interpretation, self-concepts for each of the age cohorts increased the following year of the study when all students attended Coed classes.

DISCUSSION

Two SS high schools serving the same neighborhood were reorganized to form two Coed high schools. Self-concept was measured for all students in Years 7 - 11 in each of four years that spanned the pre-transition (1982), the transition (1983), and the post-transition (1984 and 1985). For both boys and girls there was a clear increase in multidimensional self-concepts from the pre-transition to the post-transition, despite a small decrease in self-concepts for students attending Coed classes during the transition year. Sex differences in specific areas of self-concept were unaffected by the transition. Achievement grades from the state-wide School Certificate reference examination, awarded to all students at the end of Year 10, were monitored during the five-year 1982-86 period. Across the five years of the study there were no significant differences in either mathematics or English achievement. Girls performed substantially better than boys in English and marginally poorer in mathematics, but the sizes of these differences were unaffected by the transition. The results of the present investigation suggest the benefits of transition to Coed for both boys and girls in multiple dimensions of self-concept that are not at the expense of academic achievement.

The juxtaposition of the teacher perceptions with the actual test scores provides an important perspective on the transition. Teachers were in favour of the transition, perceived students to favour it, and perceived many advantages of the transition especially for boys. Teacher perceptions of the social advantages of the shift may be consistent with the observed changes in self-concept. Teacher perceptions, however, suggested that these advantages would be stronger for boys whereas girls would actually be disadvantaged in

some areas logically related to self-concept (e.g., assertiveness). In apparent contradiction to these teacher perceptions, the benefits of the transition for self-concepts were similar for boys and girls. In English achievement, teachers perceived that boys had been advantaged by the transition whereas girls were unaffected. In mathematics achievement, teachers perceived that girls had been disadvantaged by the transition whereas boys were unaffected. In apparent contradiction to these teacher perceptions, the transition had no apparent effect on the English or mathematics performances of either boys or girls. It must also be recognized, however, that teacher perceptions may reflect aspects of academic achievement, behaviour and motivation that do not show up in the School Certificate grades. Nevertheless, at least in relation to students' self-concept responses and School Certificate grades examined here, teachers may have exaggerated the benefits of the SS/Coed transition for boys and underestimated the advantages for girls.

In an interesting post-script to this study, we presented findings described here to teachers who had participated in the study and emphasized the apparent contradiction between teacher perceptions and test scores. To our surprise, the teachers did not find the apparent contradiction very surprising. After all, some of the teachers noted, many of them had believed prior to the onset of the study that girls would be disadvantaged by the transition and during the period of the intervention there had been media publicity supporting these beliefs. In this respect, their perceptions -- or at least their responses to our instrument -- may have been unduly affected by these beliefs. Consistent with these suggestions was the finding that the reports of new teachers who had not actually experienced the transition were nearly the same as those who had.

Several methodological considerations require the present findings to be interpreted cautiously, but do not appear to seriously threaten the validity of these interpretations. First, because the results are based on only two schools, the generality of the findings may be limited. The results were, however, reasonably consistent across boys and for girls so that the findings do not appear to be idiosyncratic to either of the schools. Second, there was no random assignment nor a suitable control group. Because comparisons were made across the same students, however, the matching of students in the SS and Coed conditions is probably better than has been achieved in other research in this area. Third, for designs such as this, there is no control for temporal patterns that happen to coincide with the experimental hypothesis. The achievement scores, however, were moderated against

performances by all students in the state and this provides a control for such problems. Also, the particular pattern of results for the self-concept scores -- particularly the decline in self-concepts of students attending Coed classes during the transition year -- seem inconsistent with such a proposal. Finally, the focus of this research was on outcome measures -- academic achievement and self-concept -- used to infer the effect of the transition rather than process measures about what actually happened in the classrooms before, during, and after the transition. This observation may, to some extent, account for the differences between teacher perceptions and the outcome measures.

The overall pattern of our results also bear a strong resemblance to those reported by Dale (1969; 1971; 1974). In both his research and ours, students and teachers seemed to favour coeducation, teachers perceived the primary advantages of coeducation to be social, and teachers perceived that boys were more advantaged by coeducation whereas girls were disadvantaged in at least some areas. Consistent with teacher perceptions, Dale found that both boys and girls were socially advantaged by coeducation, but he found no indication of academic disadvantages of coeducation on achievement for either sex. Similarly, our research supported the advantages of coeducation perceived by teachers but failed to identify any obvious disadvantages of coeducation for girls -- or even any differential effects of the SS/Coed transition for boys and girls. Finally, Dale's (1974) overall conclusion that the social benefits of coeducation were not at the expense of academic progress, closely parallels our conclusions. These similarities are striking given the differences between the two research programmes in time (1980s vs. 1960s), country (Australia vs. England), and methodology. The difference in methodological designs is particularly noteworthy, because the present investigation is apparently the only study to be based on differences within the same schools before and after the transition from SS to coeducation instead of the typical non-equivalent group comparison in which controlling for pre-existing differences may be problematic. Whereas there are potential problems with both designs, the apparent convergence of findings based on each provides more confidence in the interpretations of both.

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Table 1

Teacher Reactions to the Single-Sex (SS) to Coeducation (Coed) Shift

Characteristic	Percent Of Teachers Indicating:			
Favoured the SS/Coed Shift:	Disagree	Neutral	Agree	Signif.[a]
Before the shift began (1982)	14	4	82	** Coed
During the transition	16	6	78	** Coed
After the shift (1985)	18	6	76	** Coed
As a consequence of the SS/Coed Shift, overall educational quality	Poorer	No Diff	Better	Signif.[b]
For younger girls is	46	21	33	ns
For older girls is	42	13	45	ns
For younger boys is	8	24	68	** Coed
For older boys is	8	19	73	** Coed

Note. Teachers actually made ratings on a seven-point response scale that has been represented as a three-point scale to save space. All tests of statistical significance were the same for the original seven-point and collapsed three-point response scales. When a test for a given rating favoured either SS or Coed schools to a statistically significant extent, the type of school that was favoured is indicated.

** $p < .01$; ns = not significant

[a] In additional analyses it was found that the extent to which teachers favoured the shift did not vary significantly over time, and was not significantly affected by the school at which the teacher taught or the gender of the teacher.

[b] In additional analyses it was found that the teacher perceived change in educational quality differed according to student gender but not student age (or the interaction of student age and gender), and was not significantly affected by the school at which the teacher taught or the gender of the teacher.

Table 2

Teacher Perceptions of Relative Advantages of Single Sex (SS) and Coeducational (Coed) Schools For Boys and For Girls

Characteristics	For Boys: Percent Teachers Indicating				For Girls: Percent Teachers Indicating			
	SS	Little Diff	Coed	Signif[a]	SS	Little Diff	Coed	Signif[a]
1) Students prefer.....	2	6	91	** Coed	17	6	77	** Coed
2) Classroom control/discipline problems are greater in.....	28	45	28	ns	17	46	38	* SS[b]
3) Sports programmes better in	28	36	36	ns	24	37	39	ns
4) Students get along with each other better in.....	2	26	72	** Coed	12	22	66	** Coed
5) Student's desire to do well in school is stronger in.....	19	60	21	ns	54	40	6	** SS
6) The learning environment is more competitive in	23	53	23	ns	50	36	14	** SS
7) Student's concern with their dress and appearance is more in.	4	65	31	** Coed	10	44	46	** Coed
8) Student leadership qualities are better expressed in.....	16	35	49	** Coed	28	28	44	ns
9) Students are more likely to work cooperatively together in..	6	32	62	** Coed	8	31	60	** Coed
10) Students appear to be more mature in.....	9	30	61	** Coed	17	35	48	** Coed
11) Students are more willing to assert themselves in.....	24	53	22	ns	50	40	10	** SS
12) Achievement is better in Maths and Science.....	24	53	22	ns	50	40	10	** SS
13) Achievement is better in Computer Studies.....	9	79	12	ns	46	51	3	** SS
14) Achievement is better in Languages.....	6	61	37	** Coed	24	64	12	ns
15) Achievement is better in English.....	3	56	41	** Coed	18	65	18	ns
16) Achievement is better in Social Sciences.....	6	69	25	** Coed	21	67	12	ns
17) Achievement is better in Music and the Arts....	11	49	40	** Coed	31	53	17	ns
18) Achievement is better in Home Sciences.....	0	52	48	** Coed	17	66	17	ns
19) Achievement is better in Industrial Arts.....	6	79	15	ns	9	53	38	**Coed
20) Achievement is better in Physical Education....	19	56	25	ns	25	56	19	ns

* $p < .05$; ** $p < .01$; ns = not significant.

[a] Tests of statistical significance refer to whether there was a tendency for teachers to Coed schools more or less frequently than SS schools. Where there was a significant difference, the preferred type of school is indicated. [b] Because teachers indicated that for girls discipline problems are more frequent in Coed schools, SS is preferred.

Table 3

Summaries of Teacher Comments

Selected Categories of Specific Comments (paraphrased)
1) School Environment. It became more noisy at GHS, with fighting, aggressiveness and vandalism receiving comment, and became less noisy at BHS.
2) Personal/Emotional Behaviour. There was less fighting amongst boys at BHS, and relaxation and stability was higher among girls at GHS. Demands for attention by boys received strong notice by GHS teachers.
3) Social relations. Teachers from both schools noted a more balanced and mature awareness of the opposite sex, and more tolerance and understanding. Older students were seen to benefit from this awareness though younger students were seen to be distracted by it.
4) Deference Towards Opposite Sex. GHS teachers commented on girls deference towards boys -- particularly in science classes but also in sport, physical education, computing and mathematics.
5) Achievement. Overall academic achievement was seen to be lower for girls and unaffected for boys.
6) Diversification and subject choice. Diversification of activities and program offerings was noted, though GHS teachers also indicated that the male/female ratio was unbalanced for some elective offerings.
7) Impact on teachers. There was both strong agreement and strong disagreement that school life was more rewarding and pleasant. GHS teachers noted that self-awareness of sexism had increased. Many teachers commented that teaching strategies had to be altered. Teachers at both schools noted that particular experiences of teachers (outside school or prior to the study) would affect their opinions.
8). Discipline policy. A policy consistent for both boys and girls was difficult to achieve, perhaps more so at BHS than GHS. During the transition maintenance of discipline seemed more difficult at BHS, but this was temporary. GHS teachers noted that more time was spent on discipline.
9) Confounding factors. Teachers noted that there were many confounding factors both within the schools and in society in general that made the impact of the change difficult to assess.

Table 3 continued on the next page

Table 3 (continued)

Exemplar Verbatim Quotes About the Advantages of Coeducation

1) "The school more accurately reflects the outside community. While many students are not actively interested in or concerned with members of the opposite sex, they are accepting of each other and seem to be laying a sounder foundation for later contact."

2) "Better social adjustment and healthier life outlook. More realistic perception of the world. Group participation in community activities has improved."

3) "If we are to have any hope of creating a nonsexist society, we should take the first and most essential step in this direction by abolishing single sex schools. In single sex schools, the perception of the other sex as an alien race is unavoidably (though unintentionally) encouraged. If we are to help break down divisions and prejudices within society, be they based on sex, race or religion, we must begin by abandoning such divisions with the "training" ground of society, i.e., school."

Exemplar Verbatim Quotes About the Disadvantages of Coeducation

1) "Noise, aggression and behaviour of the boys. Some of the specialty programs now running and previously running have to now have a special "girls" emphasis to counteract the involvement and monopolising of the boys, e.g., computer studies."

2) "The disruptive noisy behavior of boys makes it difficult even in a staff aware of the problems for girls to cater adequately. Classroom material far too boy-oriented to maintain control."

3) "Since the changeover many of the female executive role models have disappeared from the executive to be replaced by males. This is unfortunate, particularly since next year the principal will also be male. On the stage at Assembly every week girls will see and absorb the fact that males are in these positions. In an all girls school this was obviously not the case. This is the greatest disservice we have done to these students."

Table 4

Multidimensional Self-Concept Scores Before and After the Transition for Boys and Girls

Self-Concept	Pre-transition		Post-transition		Significance		
	Boys	Girls	Boys	Girls	Sex	Time	Interaction
Verbal	47.9	49.4	49.0	52.4	*** [a]	*** [b]	* [c]
Math	50.4	49.4	51.3	49.2	***	ns	ns
Academic	49.1	49.5	50.1	51.2	* [a]	*** [b]	ns
Physical	51.2	46.8	52.7	48.7	***	*** [b]	ns
Appearance	51.7	46.8	53.4	47.5	***	*** [b]	ns
Same Sex	45.8	51.0	49.4	52.8	*** [a]	*** [b]	*
Opposite Sex	50.3	48.9	51.2	49.2	***	ns	ns
Parent	48.8	51.2	50.4	50.5	*** [a]	ns	**
Honesty	47.0	52.8	49.0	52.0	*** [a]	ns	***
Emotional	49.4	48.1	51.5	49.8	***	*** [b]	ns
General	50.0	48.1	51.8	49.6	***	*** [b]	ns
Total	48.8	48.8	51.3	50.5	*	*** [b]	ns

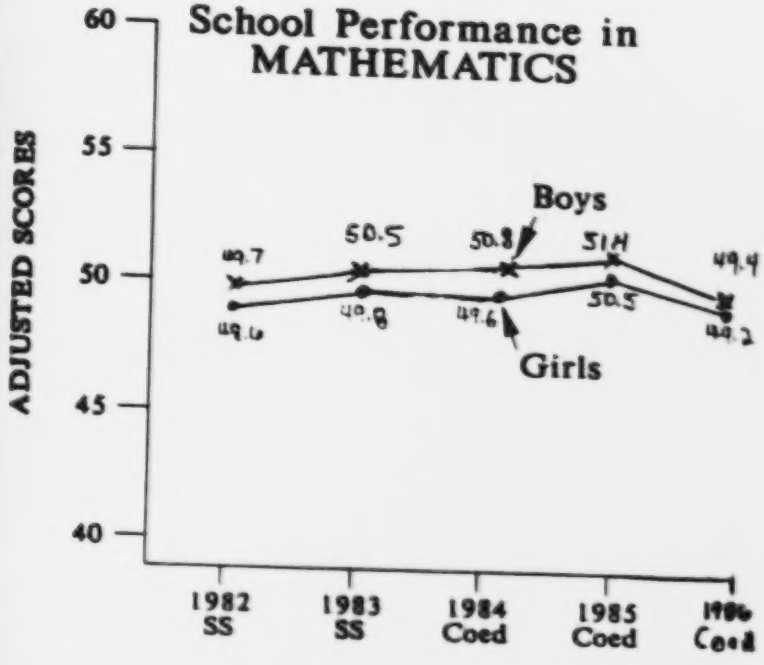
* $p < .05$; ** $p < .01$; *** $p < .001$; ns -- not significant

[a] Girls have significantly higher self-concepts than boys. For other significant sex effects boys have higher self-concepts than girls. [b] The post-transition self-concepts are significantly more positive than pretransition self-concepts. [c] The pre- post-transition shift in self-concepts is more positive for girls than for boys. Other significant effects indicate that the shift is more positive for boys than girls. In no instance for either boys or girls was the shift significantly negative.

FIGURE CAPTIONS

Figure 1. Achievement levels in English and Mathematics For Boys and Girls Attending Single-Sex (SS) and Coeducational (Coed) Schools. English and mathematics scores were each standardized (M=50, SD=10) across the five years of the study.

Figure 2. Total Self-concept Scores For Students Attending Single-sex (SS) Schools in 1982 and Coeducational (Coed) Schools in 1984-1985: Scores For All, For Boys Only, and For Girls Only.


School Performance in
MATHEMATICS
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Boys
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1982
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Coed
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Coed
1986
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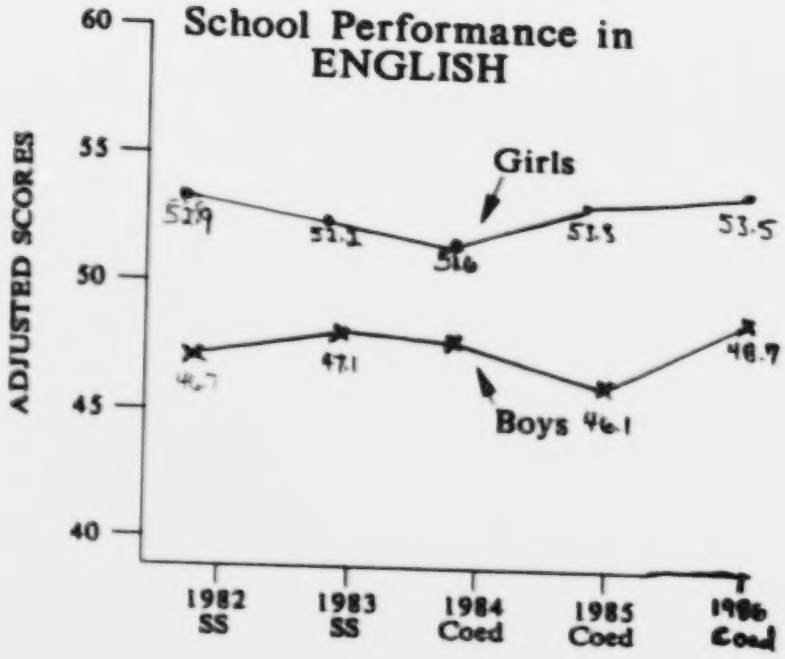
School Performance in
ENGLISH
ADJUSTED SCORES
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1984
Coed
1985
Coed
1986
Coed

1982 (SS) vs. 1984-85 (Coed)